A New Paradigm for Next-Tier In-Use-Focused HDOH Low-NO_x Regulations

A Vision for EPA's Cleaner Trucks Initiative

U.S. EPA Clean Air Act Advisory Board

Mobile Sources Technical Review Subcommittee

April 2, 2019

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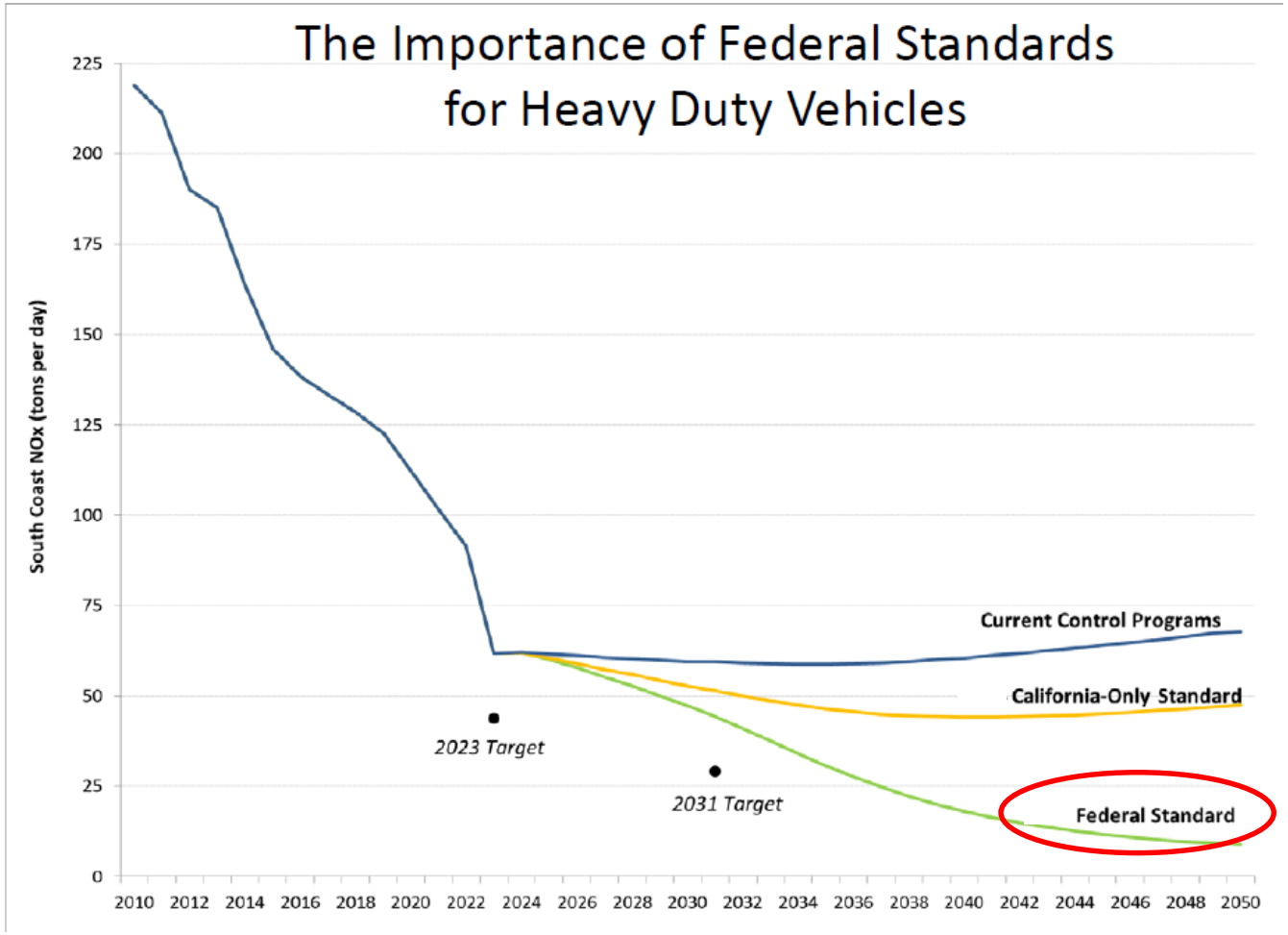
Overview

- EPA's Cleaner Trucks Initiative is a unique opportunity to implement a new paradigm of in-use-focused regulations
- Move away from prescriptive lab requirements to performance-based in-use requirements
- Continue the development and sale of a single fleet of heavy-duty engines and commercial vehicles, nationwide, that reduce GHGs and NO_X emissions in a cost-effective manner
- Promote zero-emission technologies in the heavy-duty sector
  - Manufacturers are expanding the application of zero-emission technologies to heavy-duty fleet applications, where they make sense

Nationwide HDOH NO_x Standards Generate Greater Emission Reductions than California-Only Standards



- CARB's data demonstrate that approximately 60% of the HDOH VMT in California come from out-of-state vehicles
- CARB has acknowledged that "**federal action would be far more effective at reducing in-state emissions than a California-only standard**."
- Next-tier HDOH standards should allow for the development of truck and engine technologies in a manner consistent with EPA's Cleaner Truck Initiative

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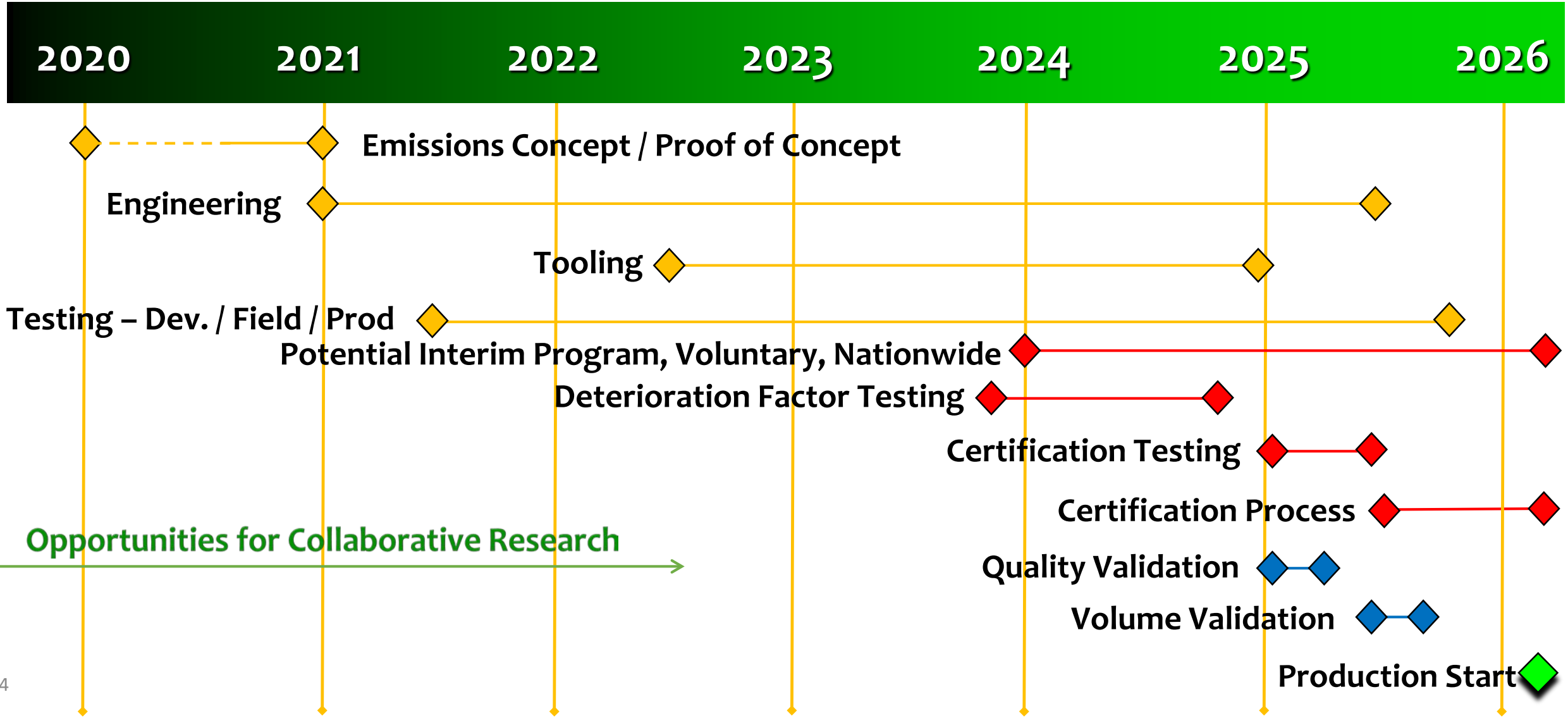
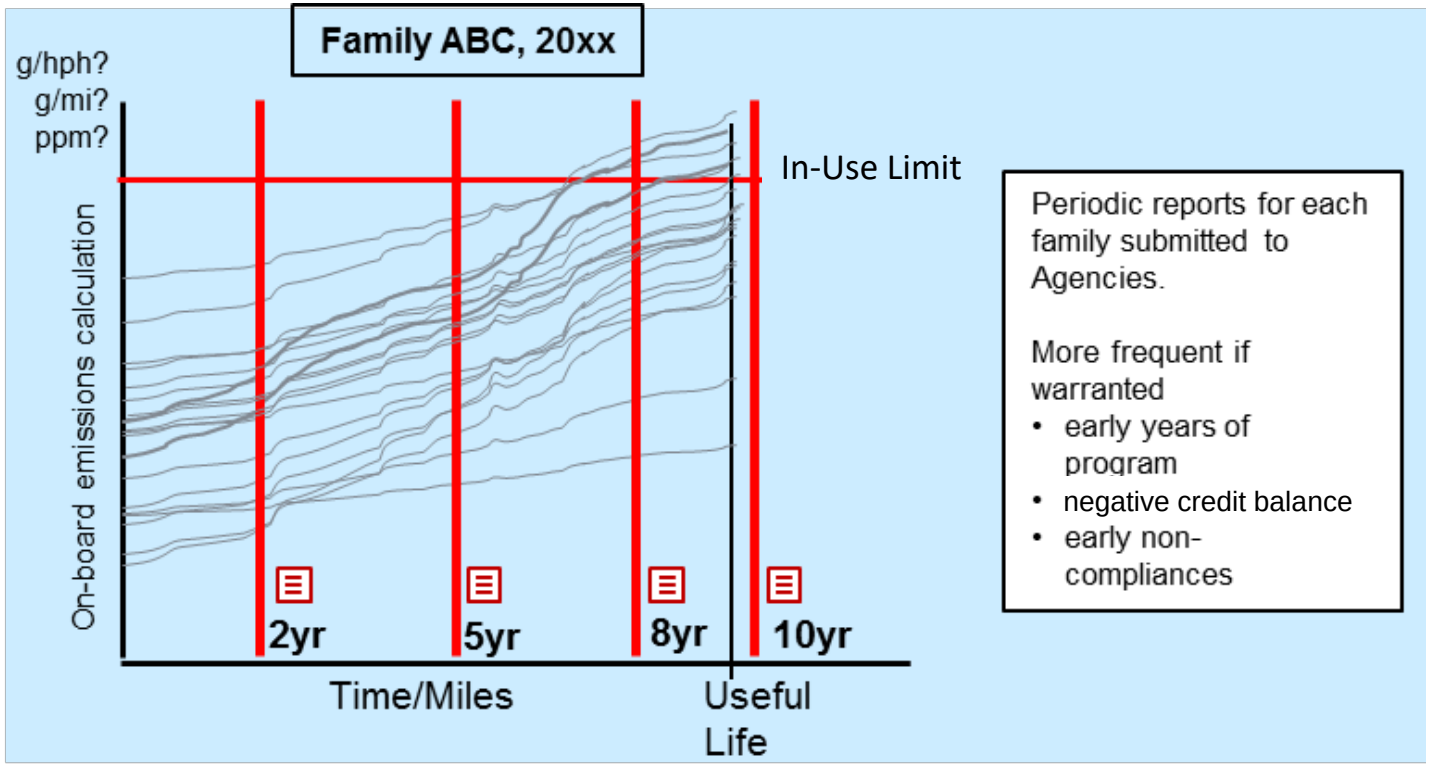
Engine Development Timeline – 2027 is the Next Opportunity for a Major Paradigm Shift 2024 Can be a Key Interim Step to Pilot a New Paradigm



Ensure In-Use Compliance Through NO_x Sensors and Telematics

- Use tailpipe NO_x sensors to measure, calculate and store in-use emission results on-board (using appropriate in-use compliance metric)
- Broadcast calculated in-use results via telematics to manufacturer
- Determine appropriate work period to use for emissions assessment and aggregation (shift-day, work-week, longer?)



- Aggregate in-use emissions from similar vehicles/engine families and compare against an in-use compliance metric
- Manufacturers would provide annual compliance reports to Agencies
- Ensure compliance through generation and use of emission credits (annual true-up) throughout useful life
- Use EPA/CARB-approved “Mini-PEMS” to audit and verify

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EMA has Already Moved Ahead with Research

- EMA has funded WVU to equip 100 in-use HDOH 2013 and later MY vehicles operating in California (representing a broad range of applications) with NO_x sensors and data-loggers (with telematic capabilities)
- Real-time in-use emissions data has been/is being gathered for 2-4 weeks from each vehicle
- Approximately 80 vehicles have been tested to date
- Resulting data will help inform the best and most cost-effective performance-based strategies for additional reductions of in-use HDOH NO_x emissions
- Initial findings already presented at March 2019 CRC and PEMS Conferences

EMA Seeks Collaboration

- The WVU data (perhaps the largest such data set) can be analyzed and aggregated to assess which types of HDOH vehicle operations/applications may be associated with a greater fraction of the remaining NO_x emissions, and to assess what level of targeted in-use NO_x reductions (and what form of in-use compliance metric) might be warranted and feasible through better optimization of advanced technologies
- The goal is to enable a potential regulatory paradigm shift to in-use performance-based regulations
- There are multiple opportunities for collaborative assessments of the WVU data

Steps to Move from Prescriptive Lab Requirements to Performance-Based In-Use Requirements

1 Evaluate technology effectiveness on in-use cycles

- Understand NO_x emission baselines (from WVU data)
- Assess potential additional NO_x controls according to vehicle applications, vehicles' day-to-day missions, and vehicles' aggregate NO_x emissions
- Consider relative volumes of each vehicle application

2 Assess measurement protocols and metrics that best reflect and promote in-use reductions

- Process real-world data using in-use compliance metrics (sum-over-sum approaches, others)
- Develop a full program to assess in-use NO_x emissions for compliance
- Pilot new paradigm and achieve additional in-use reductions
- Potentially 2024, nationwide, voluntarily

3 Implement a regulatory scheme that drives those in-use reductions. Target 2027.

- Determine appropriate in-use NO_x standard using in-use compliance metric
- Determine averaging window (e.g., shift-day) and data-aggregation protocols
- Determine mechanisms for telematic data transfers
- Develop compliance-assessment protocols
- Implement appropriate diagnostics
- Streamline existing requirements

Conclusions

There is a **unique opportunity** now to consider the development of national next-tier performance-based HDOH low-NO_x regulations that:

i. focus on the aggregate in-use NO_x performance of an engine/vehicle family over a suitable period of work (shift-day, work-week or even longer), emissions can be "binned" to examine specific modes of operation

ii. establish an aggregate in-use NO_x performance standard that is **a data-driven percentage lower than the current level of aggregate HDOH in-use NO_x performance** (e.g., some feasible and cost-effective percentage below today's in-use baseline)

iii. establish a new in-use compliance metric to assess aggregate conformity with the new aggregate in-use NO_x standard

Conclusions

iv. phase-in compliance with the new in-use aggregate NO_x standard (including through a pilot program) to allow for an appropriate transition to the new in-use-focused regulatory paradigm, verify/audit transition with “mini-PEMS”

v. pilot program would be an opportunity to achieve additional reductions in the interim

vi. include a streamlining of laboratory-based and prescriptive cycle-based compliance programs